

USING OF X-RAY IMAGING AND CT METHODS FOR LOCATING LIFE IN COMPLEX MINERALOGICAL AND LITHIC ENVIRONMENTS.

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Perhaps one of the most fundamentally difficult challenges facing those who would search for life is to detect life inside minerals. The problem is further exacerbated when conditions get extreme because much of the life moves from the clement surface environment into the pores and more clement environments inside of rocks, minerals and soils. Once encased in their lithic homes, these microbes become nearly impossible to study by standard techniques because of the opacity of the rocks.

The development of x-ray imaging coupled to computerized tomography is a well known technique that has been used by the medical profession for many years. In brief, CT is an imaging tool combining the concept of a standard x-ray device (source and detector) with a mechanism for taking "slices" of the sample, and using a computer to reconstruct these data in two or three dimensions.

Our own investigations using CT began with some collaborative studies with the CT group at the Methodist Hospital in Arcadia, CA. In this work, we successfully imaged embryos inside 65 million-year-old dinosaur eggs. The eggs, approximately 6 inches in diameter, revealed easily detectable structures that could be imaged with a resolution of several mm, and provided the excitement to proceed with the studies. The limitations for this system included the power of the X-ray source, the geometry of the system, and the software used for converting the images into three dimensional arrays.

We have now used several different CT systems, beginning with the medical scanners (Arcadia CT group) for the detection of layered communities in sandstone rocks from Antarctica. Even this crude instrument was able to point to the areas of the rock that were dominated by microbial populations – this provides the critical first information that says, "Go back and look at these sites with other methods." We have shown that without sample preparation or destruction it was possible to gain knowledge as the presence of density differences suggestive of life.